

CLAIMS:

1. An improved catalytic cracking method comprising:
 - a) providing a sulfuric acid solution containing greater than about 75 wt.% sulfuric acid;
 - b) contacting a nitrogen-containing catalytic cracking boiling range feedstream with the sulfuric acid solution in a first reaction stage under effective conditions and at an acid solution volumetric treat rate greater than about 0.5 vol.%, based on the catalytic cracking boiling range feedstream, wherein greater than about 60 wt.% of the nitrogen compounds contained in said catalytic cracking boiling range feedstream is removed thereby producing a first reaction stage effluent comprising at least a catalytic cracking boiling range effluent and a used sulfuric acid solution; and
 - c) conducting at least a portion of said first reaction stage effluent to a second reaction stage wherein said first reaction stage effluent is contacted under effective cracking conditions with a cracking catalyst
2. The method according to claim 1 wherein the nitrogen-containing catalytic cracking boiling range feedstream boils in the range of about 430°F to about 1050°F (220-565°C).
3. The method according to any preceding claim wherein nitrogen-containing catalytic cracking boiling range feedstream comprises heavy hydrocarbon oils comprising materials boiling above 1050°F (565°C); heavy and reduced petroleum crude oil; petroleum atmospheric distillation bottoms;

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petroleum vacuum distillation bottoms; pitch, asphalt, bitumen, other heavy hydrocarbon residues; tar sand oils; shale oil; liquid products derived from coal liquefaction processes; light or heavy cycle oils; and mixtures thereof.

4. The method according to any preceding claim wherein the nitrogen-containing catalytic cracking boiling range feedstream comprises vacuum gas oils boiling in the range above about 650°F (343°C).

5. The method according to any preceding claim wherein the nitrogen-containing catalytic cracking boiling range feedstream contains about 100 to about 10,000 wppm nitrogen.

6. The method according to any preceding claim wherein the nitrogen-containing catalytic cracking boiling range feedstreams has a total metals concentration ranging from about 10 wppm to about 1,000 wppm.

7. The method according to any preceding claim wherein the nitrogen present in said nitrogen-containing catalytic cracking boiling range feedstream are selected from quinolines, substituted quinolines, benzo quinolines, anilines, N-alkyl indoles, alkylarylamines and substituted derivatives thereof, indoles, and carbazoles.

8. The method according to any preceding claim wherein said sulfuric acid solution contains greater than about 80 wt.% sulfuric acid.

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9. The method according to any preceding claim wherein said sulfuric acid solution is a sulfuric acid solution obtained by:

- a) combining an olefinic hydrocarbon feedstream containing C₃ to C₅ olefins with isobutane to form a hydrocarbonaceous mixture; and
- b) contacting the hydrocarbonaceous mixture with sulfuric acid under conditions effective for producing at least an alkylate and a sulfuric acid solution having an acid concentration of at least about 75 wt. %.

10. The method according to any preceding claim wherein greater than about 75 wt. % of the nitrogen compounds contained in said catalytic cracking boiling range feedstream is removed.

11. The method according to any preceding claim wherein the treat rate of the sulfuric acid solution is about 0.5 to about 20 vol. %.

12. The method according to any preceding claim wherein the nitrogen-containing catalytic cracking boiling range feedstream and the sulfuric acid solution are intimately contacted by a non-dispersive contacting method selected from packed beds of inert particles and fiber film contactors.

13. The method according to any preceding claim wherein the nitrogen-containing catalytic cracking boiling range feedstream and the sulfuric acid solution are intimately contacted by a method selected from mixing valves,

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mixing tanks or vessels, propeller mixers, in-line static mixers, and orifice plates.

14. The method according to any preceding claim wherein the first reaction stage effluent is separated into at least a catalytic cracking boiling range effluent and a used sulfuric acid solution by any means known to be effective at separating an acid from a hydrocarbon stream.

15. The method according to any preceding claim wherein the catalytic cracking boiling range effluent and the used sulfuric acid solution are separated by a separation device selected from settling tanks or drums, coalescers, electrostatic precipitators, or other similar device.

16. The method according to any preceding claim wherein the catalytic cracking boiling range effluent and the used sulfuric acid solution are separated by fiber film contactors.

17. The method according to any preceding claim wherein the catalytic cracking boiling range effluent has a lower total metals concentration than the cat cracker boiling range feedstream.

18. The method according to any preceding claim wherein the catalytic cracking boiling range effluent has a total metals concentration ranging from about 20 wppm to about 1000 wppm.

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19. The method according to any preceding claim wherein water is added to said sulfuric acid solution to adjust the sulfuric acid concentration of said sulfuric acid solution.

20. The method according to any preceding claim wherein the sulfur content of said catalytic cracking boiling range effluent is about 0.1 to about 25 % lower than the cat cracker boiling range feedstream.

21. The method according to any preceding claim wherein the yield loss resulting from the sulfuric acid solution treatment is about 0.5 to about 30 wt.%.

22. An improved catalytic cracking method involving removing nitrogen from a nitrogen-containing catalytic cracking boiling range feedstream comprising:

- a) providing a sulfuric acid solution containing greater than about 80 wt.% sulfuric acid;
- b) contacting a nitrogen-containing catalytic cracking boiling range feedstream boiling in the range of about 430°F to about 1050°F (220-565°C) in a first reaction stage with a sulfuric acid solution under effective conditions and at an acid volumetric treat rate of about 0.5 to about 20 vol.%, based on the catalytic cracking boiling range feedstream, thereby producing a first reaction stage effluent comprising at least a catalytic cracking boiling range effluent and a used sulfuric acid solution, whereby greater than about 75 wt.% of the nitrogen compounds contained in said

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catalytic cracking boiling range feedstream is removed and said contacting is achieved through the use of a contacting method selected from non-dispersive and dispersive contacting methods; and

- c) conducting at least a portion of said first reaction stage effluent to a reaction stage wherein said first reaction stage effluent is contacted under effective cracking conditions with a cracking catalyst.